Engineers Australia

Engineering Heritage Victoria

Nomination

Engineering Heritage Australia Heritage Recognition Program

McKILLOPS BRIDGE

OVER THE SNOWY RIVER

APRIL 2019

Front Cover Photograph Caption

McKillops Bridge looking towards the western abutment with the Turnback Track in the background.

This image was taken on 13 March 2010 with my trusty Nikon D90 standing right on the eastern bank of the river which is a very low level after the summer. The pier in the centre of the image is the Central Pier, the only one to which the bridge truss is attached and the one that failed in when the original bridge was washed away on 8 January 1934. The river is flowing from right to left.

Note that in this image there is some debris resting against the upstream face of the pier. Such debris is the Achilles Heel of this bridge but it has stood strong against many floods, with their debris since it was opened in December 1935.

It was tested with a herd of 700 cattle on its deck, not then, or now, being at a place where steam rollers and traction engines could be assembled to carry out a more traditional test.

Despite the building of great dams and the diversion inland of much of its water by the Snowy Mountains Hydro-electric Scheme the flash flood flows in this part of the Snowy River have not reduced and it remains the wildest and most unpredictable river in Australia.

Long may it remain wild and long may it be crossed by the elegant McKillops Bridge.

Image: Owen Peake

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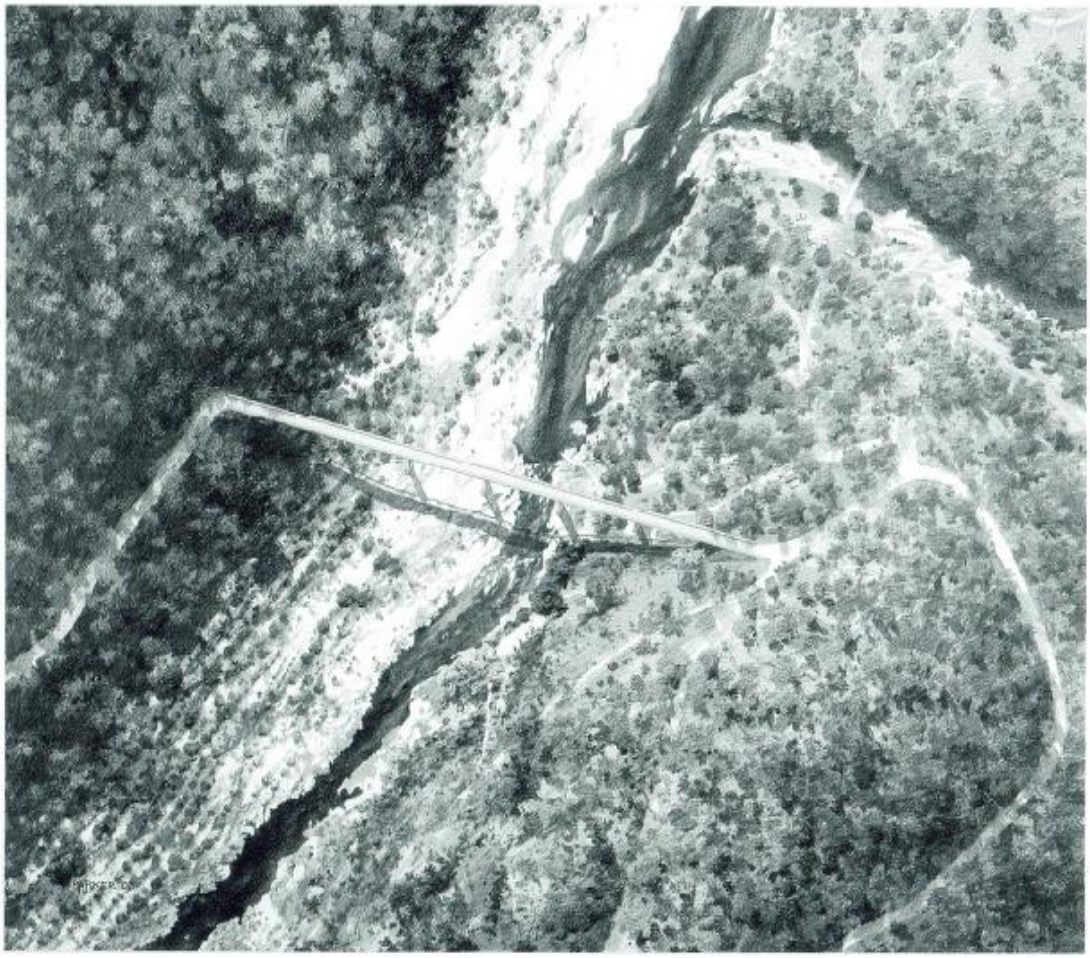

10. 450 x 570 mm, graphite pencil on CA grain paper

Drawing by Kevin Parker of McKillops Bridge as if taken from a drone. The Snowy River runs from top (north) to bottom (south) in this drawing. The left hand side of the drawing is the western approach to the bridge. The Deddick River is in the extreme top right hand corner. With permission from artist Kevin Parker.

1 Introduction

The Snowy River, in its deep gorge between a point close to the Victorian and New South Wales border and the town of Orbost on the river's flood plain has always been a dangerous river to cross and has taken many lives of those who dared to cross it.

Aboriginal Australians crossed the river for thousands of years, probably tens of thousands of years, before White Men arrived on the scene. The Ngarigo people of Monaro and the Theddora people of Omeo met for trade, social and cultural reasons from antiquity.[1]

European Settlers arrived in the 1830s and they fared no better. The site at McKellar's Crossing, as it came to be called, was serviced with a punt for many years and this site became a crossing on a stock route between the Monaro and Gippsland. However the crossing could only be used at times of low river flows and this was a major annoyance to the stockmen driving cattle and sheep across the mountains.

Perhaps the first serious proposal to build a bridge came from the Victorian Country Roads Board (the legendary CRB) in 1928 when the body proposed a low level structure.[2]

In 1931 a contract was let to a Melbourne firm, Gardener Constructions, to build a high level bridge. [3] This was to be of a structure similar to the extant bridge but with a clearance (over the highest recorder flood peak of the previous 60 years) of three metres.[4]

The bridge was built and an opening ceremony was planned for 19 January 1934.[5]

On 8 January 1934 a storm produced heavy rainfall over the river above the bridge. The new bridge was washed away later in the day. [6]

A second bridge was commenced very quickly with a greater clearance over the river bed. This time the bridge was made 15 feet higher or 19 feet above the great flood of 1934.[7]

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[1] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 2. 2014.

[2] The Sydney Morning Herald (NSW: 1842-1954.Friday 28 September 1928). This reference can be found at Trove Newspapers, National Library of Australia.

[3] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 15. 2014.

[4] Probably ten feet which is 3.048 metres.

[5] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 32. 2014.

[6] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 33. 2014.

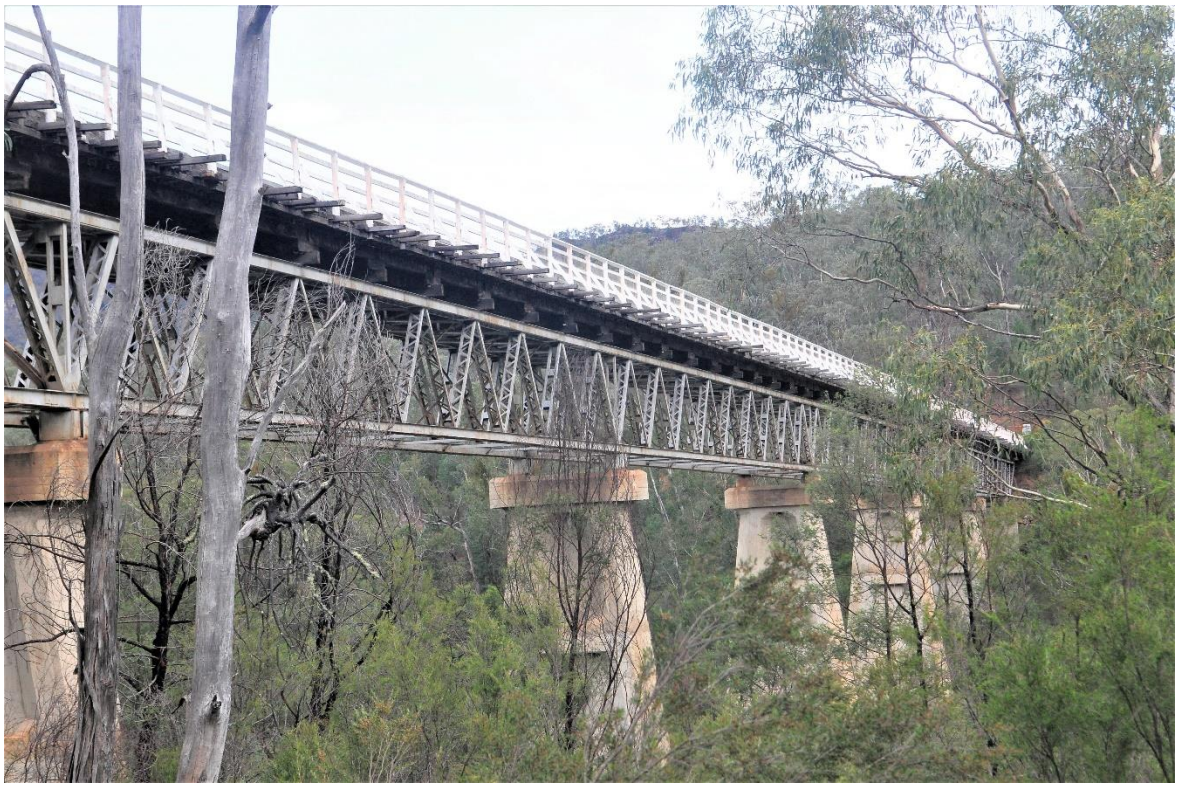
[7] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 37. 2014.

The second bridge was completed by December 1935 and the official opening took place at midday on 20 December 1935 and was attended by 250 people.[8]

The bridge has remained in service since the opening with some repairs having been made. There have been many floods but the bridge has stood firm. The bridge is also vulnerable to bushfires which are common in the area and difficult to fight due to the rugged terrain. Some minor fire damage did occur in 2011 but this is thought to have been caused by a dropped cigarette butt, not a bushfire.[9]

A major restoration of the deck was carried out by VicRoads in 2012.[10] There were no major changes in the design of the upper works of the bridge at this time.

Over the life of the bridge many efforts have been made to improve the condition of the road on the western side of the bridge from Turnback to the bridge approach. The road remains unsealed, narrow steep and dangerous but passing places have been incorporated to make two way traffic less problematic.



Mc Killops Bridge. View from the north east, April 2019.
Image: Owen Peake.

[8] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 37. 2014.

[9] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 46. 2014.

[10] Rhonda Coates.McKillops Bridge, The history of the Superstructure over the Snowy River.Tubbut Neighbourhood House.page 37. 2014.

2 Heritage Award Nomination Letter

Learned Society Advisor
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of work: McKillops Bridge over the Snowy River

The above-mentioned work is nominated to be awarded an Engineering Heritage Marker.

The bridge is located at: There is no nearby town. The co-ordinates are: 37° 5.047' S 148° 24.811' E to the centre of the bridge.

Owner: VicRoads

The owner will be advised of this nomination once it has been approved by EHA and a letter of agreement from the owner to recognise the site will be sought.

Access to site: The bridge is on a public road called the McKillop Road (C611). Note that the road approaching the bridge from the west is steep, narrow and dangerous.

The Nominating Body for this nomination is Engineering Heritage Victoria

David LeLievre
Chair
Engineering Heritage Victoria

Date: April 2019

3 Heritage Assessment

3·1 Basic Data

Other/Former Names: McKellar's Crossing, particularly before the bridge was built.
Location: Between Buchan on the western side of the valley and Tubbut on the east on the C611 McKillops Road where it crosses the Snowy River.
Map co-ordinates: 37° 5.047' S 148° 24.811' E to the centre of the bridge.
Elevation: 175 metres to the bridge deck.
Address: Nearest Town: Buchan and Tubbut.
State: Victoria
Local Govt. Area: East Gippsland Shire Council. Council seat is Bairnsdale.
Owner: VicRoads.
Current Use: Single lane Highway Bridge sometimes used to cross cattle and sheep.
Former Use: Crossing for cattle and sheep primarily with some light vehicle traffic and horse traffic.
Designer: Country Roads Board, Victoria.
Maker/Builder: First Bridge, Gardener Constructions, Melbourne. Second Bridge (after the first was destroyed by a flood) Henham Brothers.
Year Started: First Bridge 1931. Second Bridge 1934.
Year Completed: First Bridge 1934. Second Bridge 1935.
Physical Description: Two parallel steel Warren trusses continuous across all intermediate piers with bracing between them, supported on five reinforced concrete A frame piers. The upper structure is complex consisting of four principal layers of timber structure as follows:

- Transoms at each point where the diagonal members of the trusses connect to the top chord.
- Two very heavy timber girders running parallel to and nearly above the trusses.
- Transverse decking with spaces between deck planks to allow dirt to fall through. Some decking planks are extended outboard of the hand rails to carry diagonal braces for the handrail posts, outside the roadway.
- Two running strips of 6 planks each on the deck planking at suitable spacing to accommodate vehicle traffic.

There is a substantial handrail on each side of the roadway. The timber posts are bolted to the outside of a kerb resting on the deck planks. The top rail of the handrail is mounted diagonally (diamond –fashion) in 'V' slots in the top of the posts. There are four intermediate rails. The posts are braced, outside the roadway, by diagonal timber members connected to the longer decking planks.

More detail of the construction is at Appendix 2. The drawing on the next page shows the deck from above.

Physical Condition: Major restoration was carried out by VicRoads in 2012. The bridge is maintained as part of the Victorian Country Road system by VicRoads and is considered to be in good condition.

15. 510 x 420 mm, graphite pencil on CA grain paper

Drawing by Kevin Parker of McKillops Bridge showing the deck. The northern handrail is prominent and the two sets of running strips can be seen in the roadway laid over the transverse decking.
With permission from artist Kevin Parker.

3·2 Historical Notes

3·2·1 The Aboriginal Past

For tens of thousands of years the Aborigines crossed the Snowy River in the vicinity of the McKillops Bridge site because the river was just a little quieter here than in other places. Nevertheless the Snowy River is a dangerous, wild river and a large one. Only the Goulburn River challenges the average water volume in the Snowy River in Victoria [11]. Furthermore the river is notorious for its unexpected flash floods, caused more by rainfall in the Monaro that the runoff from the Snowy Mountains higher up [12].

The local Aborigines used the route for trade, cultural interaction and to hunt and collect other resources between the Monaro and the Gippsland plains. They had the enormous advantage of long familiarity with the land and traditional knowledge which the White Men who followed them did not have. Nevertheless they probably suffered many disasters at this crossing and at times would have been seriously delayed.

3·2·2 The Arrival of the White Man

White settlers arrived in this area remarkably early in European settlement of Victoria. Gippsland offered the comfort of a more familiar countryside than most of Australia with its rolling green hills [13]. The presence of a large river (now called The Snowy River) near Orbost would have raised the question “Where does it come from?” and they would have followed it upstream. They would have been followed by other settlers looking for minerals (tin was mined in the vicinity of McKillops Bridge and the settlers had an insatiable appetite for timber.

The settlers in the vicinity of Orbost soon discovered that the floor plains of the lower Snowy River were flood prone, made worse by the unpredictable exit of the river through ever-moving lakes and sand dunes at the coast to the sea.

The crossing at McKellars Crossing was used by settlers for the same reason that the aborigines used it. After the arrival of McKellar there was a punt service which, in itself, was none too safe. Various forms of assistance, to travellers crossing the river existed, on and off, at this point right up to the construction of the bridge in the mid-1930s.

The crossing straddled a major stock route from the Monaro to Gippsland. Cattle and sheep were often moved along this router for agistment [14] if one area was drier than the other. Crossing sheep and cattle flocks/herds at McKellars crossing was difficult, time consuming and dangerous both to the stock and the drovers. There was not a lot of grazing land along the river in the vicinity so waiting for the river to drop so that a crossing could be made involved a difficult balancing act. When McKillops Bridge was eventually built it was the crossing of stock which formed the major justification rather than

[11] George Seddon. Searching for the Snowy, An Environmental Story. Allen & Unwin Pty Ltd.1994.page 247, Management of the River.

[12] Opinion by Owen Peake.

[13] Opinion by Owen Peake.

[14] Wikipedia on Agistment: https://en.wikipedia.org/wiki/Agistment

the crossing of motor vehicles.

In 1889 the State Government [15] finally decided to put some funds towards maintaining a ferry service at Turnback Crossing. Duncan McKellar was employed at a rate of 75 pounds per year. The State Government contributing four-fifths and the Tambo and Orbost shire Councils the remaining 15 pounds. McKellar was born in 1844 in Grenwich, Scotland, and came to Australia with his parents about 1846. He had worked in the Monaro area before he was employed at Turnback Crossing. He was described as a tall raw-boned Scotsman, a rather serious man but an expert oarsman and he became known locally as 'Punty' [16]

Punt in operation at McKellars crossing.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Heather Livingstone.

[15] State Government is a misleading term for 1889 as Federation, and hence the existence of the states, did not occur until 1901. Victorian Government might be more accurate although I think we all know what we are talking about.
[16] Rhonda Coates. McKillops Bridge, The history of a superstructure over the Snowy River.Tubutt Neighbourhood House.2014.page 8, Duncan McKellar.

The Snowy River looking upstream from the eastern bank under the bridge. Taken in April 2019 after a dry summer this view shows less water in the river than the previous historical image. Much of the water now in the river is environmental flow from the Snowy Mountains Hydro-electric Scheme. Image: Owen Peake.

Similar to the image below but looking downstream. Image: Owen Peake.

3·2·3 First Proposal for a bridge

In 1928 the Country Roads Board (CRB) proposed a low level bridge at McKellars crossing and allocated 5000 pounds to build it. When it was realised that flash floods would make such a bridge unusable for much of the year this idea was discarded.

Later the same year the CRB, having decided that only a high level bridge would do the job, provided an estimate of 28 500 pounds for a bridge 750 feet long, 16 feet wide and built on concrete piers supporting steel trusses and a timber deck. This estimate was considered too high and the CRB looked for potential savings, reviewing the estimate down to 12 500 pounds. The saving was achieved in three areas:

- The use of locally available granite to make the gravel required for concrete mixing. The usual material used for making gravel in Victoria was bluestone (basalt) [17].
- A fall in the world price of steel.
- The use of electric arc welding for fabrication of the trusses. This technique was quite new but had great advantages in that the size of steel sections could be reduced (hence reducing the mass of the structure) because the weakening of the members due to the holes drilled to accommodate rivets were no longer required. This change reduced the mass of steel required from 160 tons to 120 tons, a very large saving considering the significant transport difficulties of getting the steel from Lakes Entrance (the closest port) via rough bush tracks to the bridge site. This key decision proved to be technically superior, as seen by the mangled trusses after the first bridge was swept down-river. The trusses were twisted and bend to an unrecognisable extent but there were no broken welds!! Furthermore the use of welded fabrication further accelerated the trend to welding which would all but eliminate riveted construction within a very few years [18].

The CRB was well aware that a major risk for this bridge would be the massive forces applied to the piers during flash flood events. The number of piers were therefore reduced and the piers were strengthened. This proved to be a critical factor and perhaps, even with this insight, the piers were not robust enough. When the first bridge failed one pier also failed. The CRB engineers were not the first, or the last, to underestimate the mighty Snowy [19] [20].

[17] Wikipedia article on Bluestone: https://en.wikipedia.org/wiki/Bluestone

[18] Opinion by Owen Peake.

[19] Opinion by Owen Peake.

[20] Rhonda Coates. McKillops Bridge, The history of a superstructure over the Snowy River.Tubutt Neighbourhood House.2014.page 15, The First Bridge.

3·2·4 Building the First Bridge

In 1931 a contract was let to Melbourne firm Gardener Constructions to build the bridge. With a deck height of 58 feet 17.7 m) above the stream bed the design incorporated a three metre clearance above the highest flood level recorded during the previous 60 years [21].

At the time of contract letting the estimate for the work was 11 950 pounds [22].

An early challenge was transporting the steel for the trusses to the site. The trucks suitable for this task could carry around two tons of steel per trip with a maximum length of 40 feet (12.2 m). The steel was strapped to the side of the trucks, protruding a great distance both front and back. Even then the trucks had great difficulty negotiating the tight turns, particularly on the Turnback Track section approaching the bridge site [23].

Construction workers lived in tent accommodation on site. The camp seems to have been well thought-out with radio communications to the outside world, a first aid tent and provision of food services [24].

[21] Rhonda Coates. McKillops Bridge, The history of a superstructure over the Snowy River.Tubutt Neighbourhood House.2014.page 15, The First Bridge.
[22] Rhonda Coates. McKillops Bridge, The history of a superstructure over the Snowy River.Tubutt Neighbourhood House.2014.page 16, The First Bridge.
[23] Rhonda Coates. McKillops Bridge, The history of a superstructure over the Snowy River.Tubutt Neighbourhood House.2014.page 16, The First Bridge.
[24] The details of how food was prepared are unclear. Some images show workers cooking for themselves over open camp fires but there must have been some central facilities and there is reference to a 'cook' who did not always turn up. Food was brought mainly from Buchan including meat and bread.

Construction camp tents.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Kay Family.

Small truck delivering 40 foot long steel sections to the construction site.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Dorothy Moore.

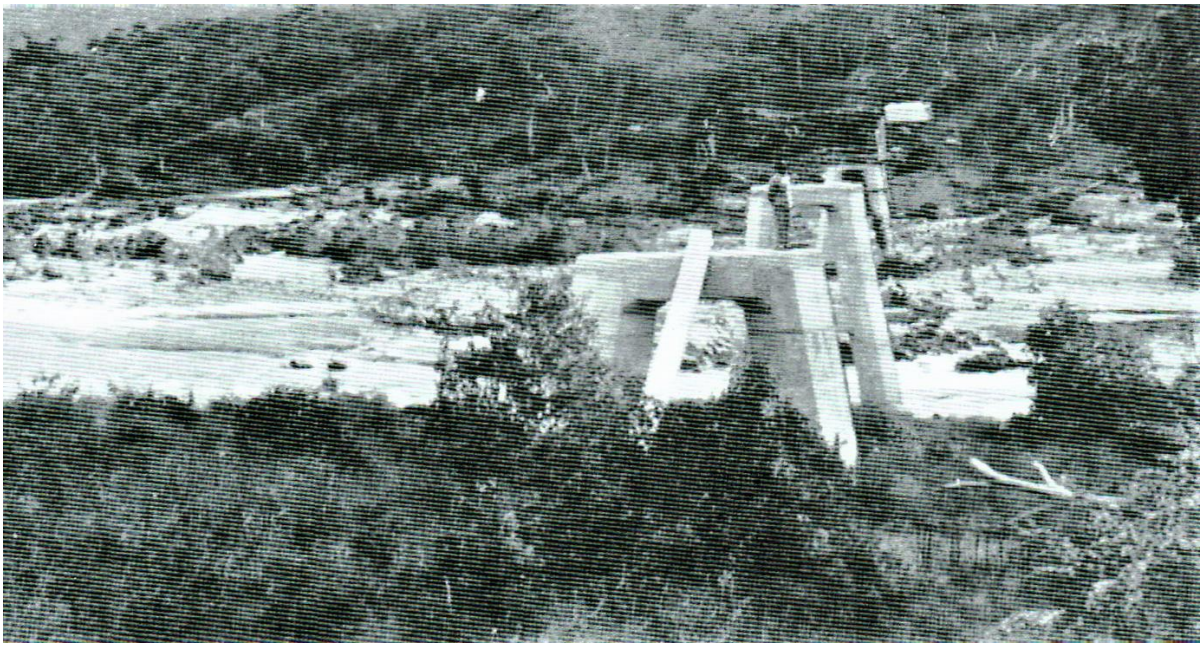
Building proceeded with the basic construction divided into the following sections:

- Improvement of approach roads, particularly on the western side of the river.
- Building the piers.
- Fabrication and erection of the trusses.
- Fabrication of the timber deck on the trusses.

The Turnback Track was very steep, narrow, dangerous and not suitable for construction of the bridge let along for public traffic once the bridge was completed. Work was carried out during bridge construction but the track was still far from easy. Even up to the present time it is a difficult section of road, perhaps less frightening in these days of robust 4WD vehicles but nevertheless a challenging track.

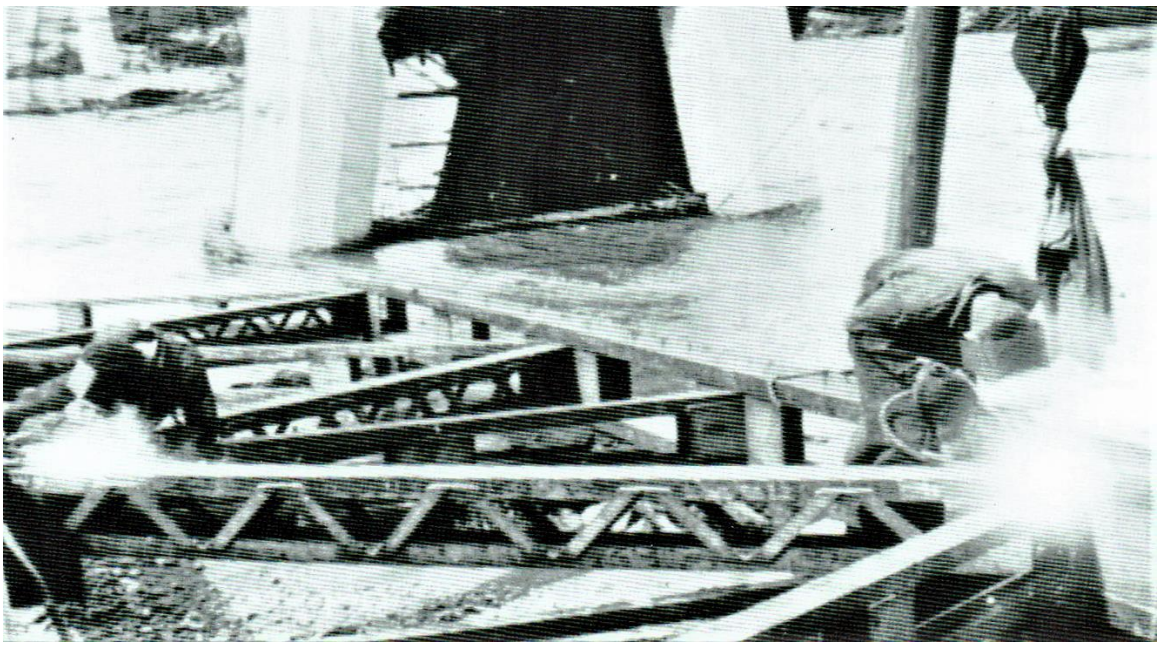
The approach on the eastern side is less challenging.

Construction of the piers, although very large concrete structures in their own right, appears to have gone without incident. The foundations depended on deep drilling and grouting of large pins to engage with the concrete structure. This seems to have been an advanced design feature in the 1930s but was clearly successful.



Piers under construction.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Kay Family.

The trusses were fabricated on the river bank as close to where they were to be placed as possible. It seems that finding large enough flat space for this part of the operation would have been a challenge but they overcame this and the erected trusses appear to the naked eye to be dead straight.



Welding a truss. Note that two welders and that the river is very close to their work site. Image: Taken from Rhonda Coates, McKillops Bridge. Image by Kay Family.

Raising the trusses to rest on the concrete piers seems to have been carried out by very simple lifting equipment. The men involved clearly included very skilled riggers. Once in place on the piers cross bracing was fitted to stabilise the twin trusses.

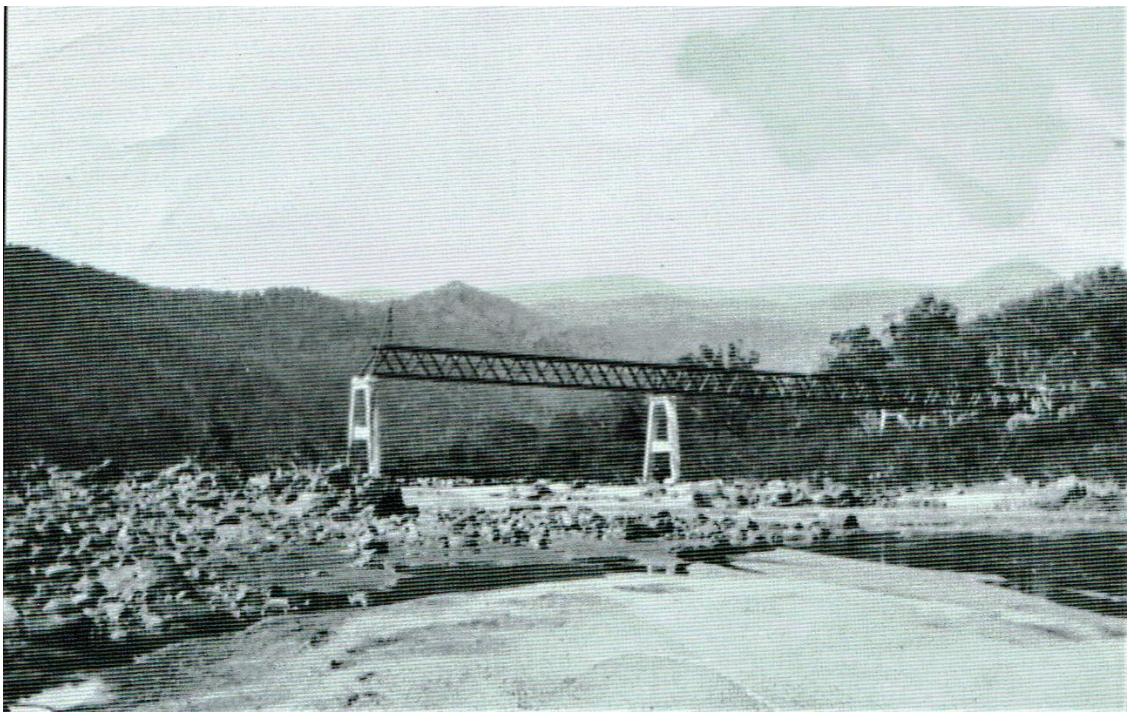
Erecting the timber deck was relatively straight forward once the trusses were in place. To the current-day engineer's eye the health and safety arrangements for this work were very basic. There were certainly no barriers used and the very last operation in the building of the deck was the erection of the handrails. These handrails were substantial as they were designed with the possibility of an out-of-control herd of cattle rampaging along the deck in mind.

On site there are many images of horse –drawn vehicles to carry materials and assist with erection. There were also steam engines to drive winches and other heavy machinery. Despite the isolation this was a well-equipped work site for its day.

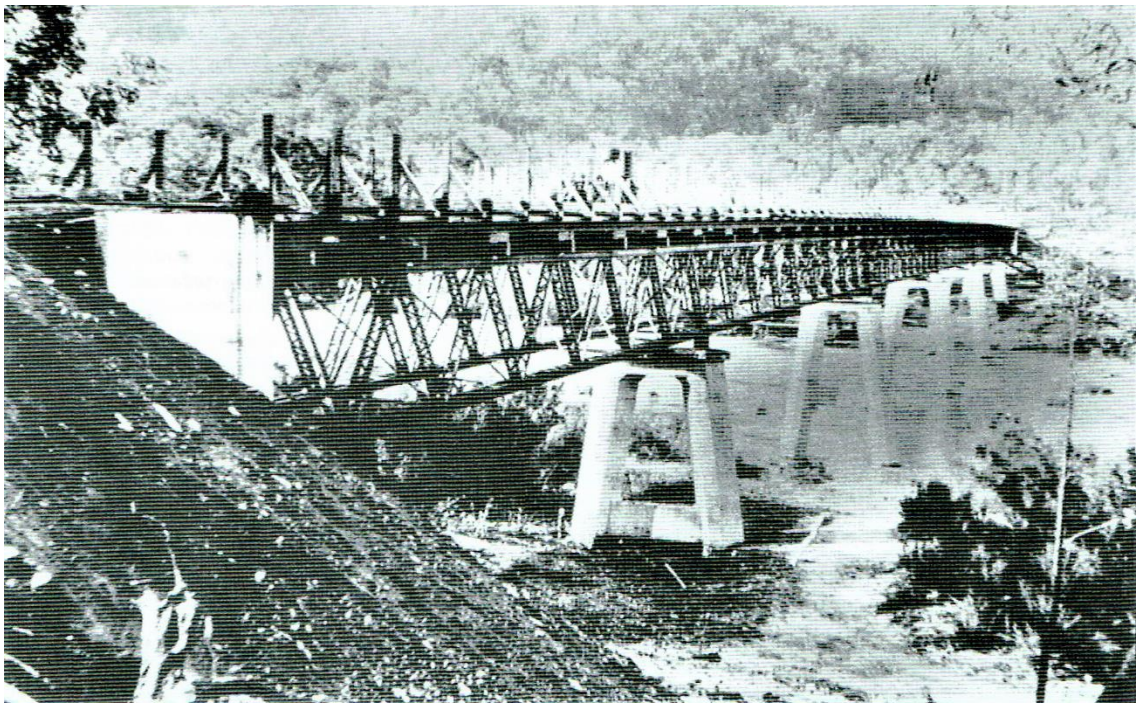
Clearly a significant part of the workforce would have been involved in second tier tasks such as camp management, camp services including food, transport of materials and people to the site, transport around the site, collecting and cutting firewood, keeping at least one boiler up to steam and caring for horses.

Drilling holes for attachment bolts in heavy timbers for the deck.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Reidy Family.

The deck takes shape. Note the safety provisions at the edge of the deck.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Helen Neven.



Trusses erected half way across the river.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Charlie Hodge.



Installation of the handrails in progress.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Orbost Historical Society.

3·2·5 The Flood which destroyed the First Bridge

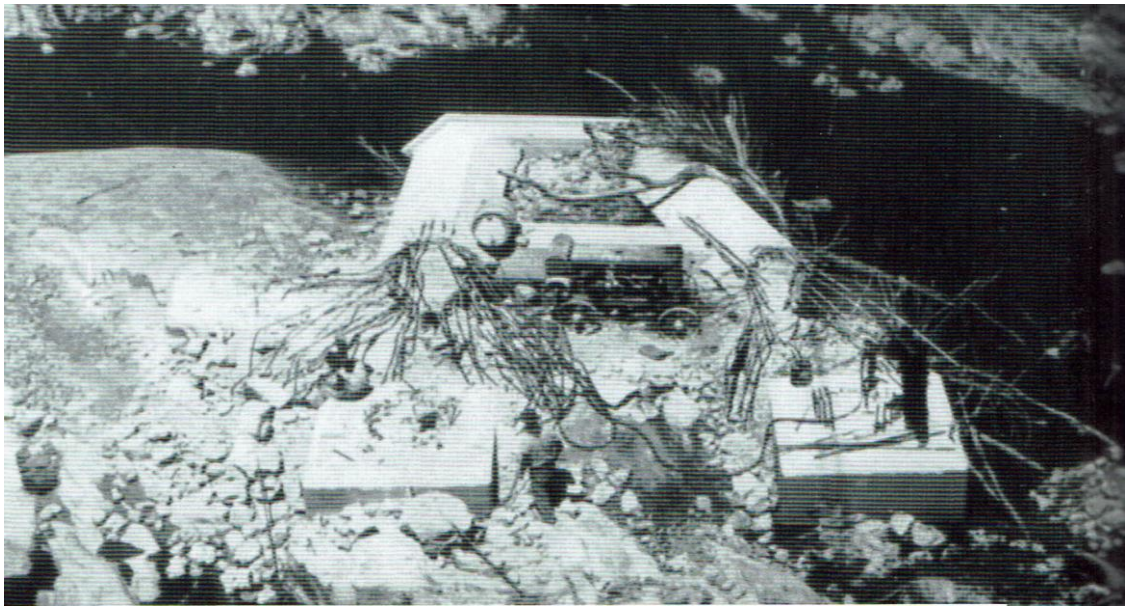
On 8 January 1934, just a few days before the planned opening of the new bridge, a flash flood swept down the Snowy from the Victoria/New South Wales border area and exceeded the historical river height at McKillops Bridge. The river level came above the lower level of the trusses and debris, carried by the river, soon accumulated behind the bridge. The bridge trusses acted as a weir and massive quantities of timber and other floating debris piled up, upstream of the bridge for up to half a kilometre. The pressure of this debris tore the trusses from the top of their piers and swept the bridge upper works downstream in a mass of twisted steel and broken timber. The centre pier was also torn down.

The river raged on and destroyed much of the bridge at Orbost, at the mouth of the canyon of the Snowy.

The remains of the bridge after the trusses and deck were swept away on 8 January 1934. At the time of this image being taken the river level had reduced from its maximum level. Image: Taken from Rhonda Coates, McKillops Bridge. Image by Mona McLeod.

Twisted remains of the bridge trusses and deck in the river bed some hundreds of metres downstream from the bridge site.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Dorothy Moore.

Detail of twisted remains of the bridge trusses showing the forces inflicted by the river.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Dorothy Moore.



Remains of the centre pier after the collapse.
Image: Taken from Rhonda Coates, McKillops Bridge. Image by Orbost Historical Society.

The destruction of the bridge was most discouraging for the Country Roads Board engineers. They had learnt that their calculations of the safe bridge height were not sufficiently conservative and that the piers needed to be strengthened. They raised the piers by 15 feet (4.575 metres) and filled in the open 'A' frame structures of the piers to prevent loading from debris being caught and held in the open structures.

The first cattle were driven across the new bridge on 13 November 1935 by the same Mr Hayden who had been the first to cross the original bridge, riding the same horse! The official opening of the bridge occurred on 20 December 1935 with about 250 people in attendance. Not a bad attendance for a bridge very much in the middle of nowhere.

3·2·6 History of the Bridge after the New Bridge was Commissioned

In the years immediately after completion of the bridge the major concern was the dangerous state of the approach road on the western side of the bridge. In 1936 the CRB placed 120 men on the roadworks and the project went on for one year. At the end of this time the road was considerably widened with cars able to pass one another in many places. Nevertheless there were sections where cars could not pass and if cars met head on in these sections one of the cars had the reverse back to a place where the road was wide enough to pass.

In October 1936 the CRB decided to test the bridge. A herd of 700 cattle were used to test the bridge. This mob of cattle approximated the bridge design load and the CRB attached instrumentation to measure the movement under the load of the cattle. The cattle were brought to the bridge the previous evening and held until early the next morning. The instruments indicated that there was very little deflection of the bridge under this load.

Over the years there have been many major floods in the Snowy River. However none have reached the height of the trusses. The damming of the river high up in the Snowy Mountains in New South Wales has not reduced the flash floods which are generated by large thunderstorms above McKillops Bridge in the farmed areas of the Monaro but below the Snowy Dams. The bridge has stood strong against all these floods and has not suffered any damage.

The greater risk for the bridge has been bushfires. The timber upper structure of the bridge is vulnerable and required protection and monitoring in the event of a fire coming close. During the serious fires of 2003 and 2014 the bridge turned red after fire retardant was applied to the deck to protect it. During these events back-burning was used to further protect the bridge.

In 2005 the Tubbut community, East Gippsland Shire Council, VicRoads and Parks Victoria celebrated the 70th birthday of the bridge. There were speeches, demonstrations of skills associated with the area and the bridge such as blacksmithing and sleeper cutting.

In 2007 there was a major land slippage on the western approach road. The bridge was not able to be used for several months whilst this slippage was repaired.

In 2011 a mysterious fire burned a small section of timber in the bridge deck. This was not bushfire related but was thought to have been caused by a dropped cigarette butt. The damage was easily repaired but could have been much worse.

In 2012 VicRoads carried out major repairs to the timber structures of the bridge. This included replacement of deteriorated cross deck planks, reducing excessive gaps between some planks and repairs to the handrails. This work was carried out under contract by Citywide.

Other improvements have also been made by VicRoads including the installation of Armco safety barriers inside the timber safety barriers on each side of the deck.

The bridge has traditionally been painted white (upper structure) periodically. On one occasion it was painted mist green but locals complained that the bridge had ‘disappeared’ from the landscape and it was repainted its usual white. Whilst a bridge structure of the magnitude of McKillops Bridge may seem out of place amongst the dramatic natural bush of the area the bridge is viewed with immense pride by the locals and making it appear less prominent did not amuse the locals!

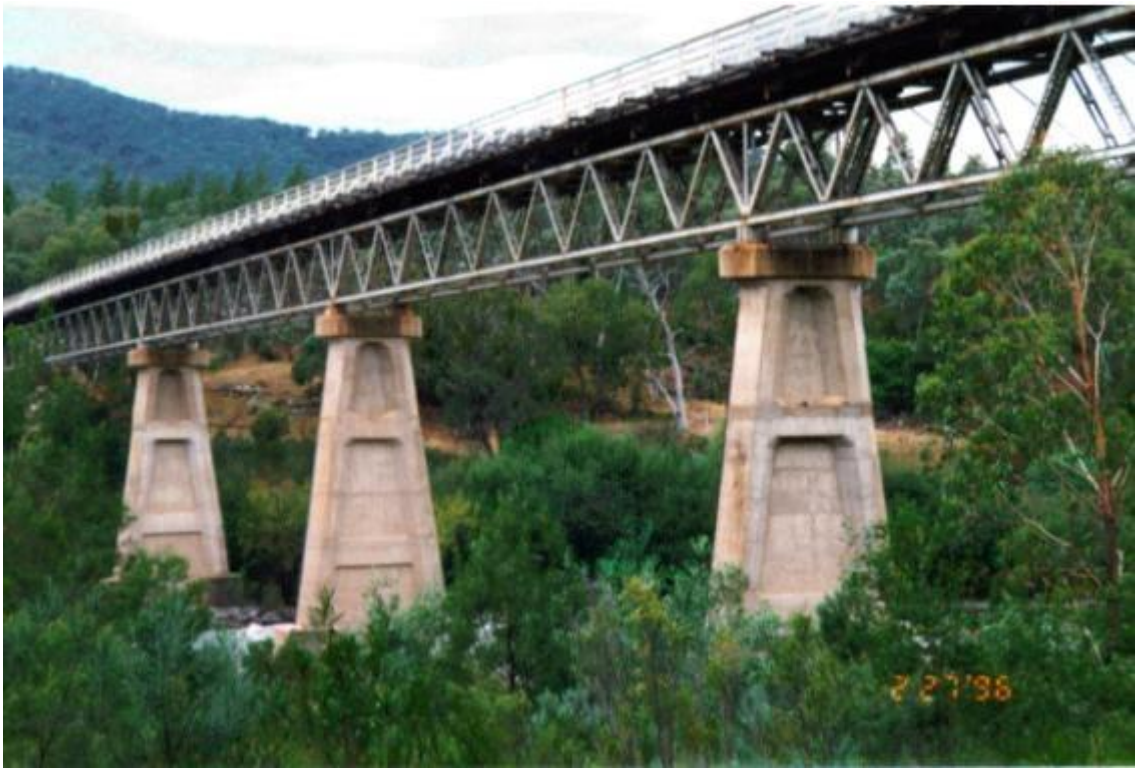
3·3 Heritage Listings

Name: **MCKILLOPS BRIDGE**
Number: VHR1849

Victorian Heritage Register

HERITAGE COUNCIL VICTORIA

MCKILLOPS BRIDGE
OVER SNOWY RIVER, McKILLOPS ROAD DEDDICK VALLEY and McKILLOPS ROAD WULGULMERANG EAST, EAST GIPPSLAND SHIRE



Statement of Significance

Last updated on - September 3, 1999

What is significant?

McKillops Bridge is a road and live-stock bridge situated on the Bonang-Gelantipy Road across the Snowy River. It consists of welded-steel trusses seated on tall one-piece reinforced-concrete piers, supporting an elaborate timber stockbridge superstructure. That traditional colonial-style timber superstructure seated on crossheads above the trusses has shaped corbels, square-timbered stringers, spiking planks, transverse timber decking (now with running planks), gravel beams, and elaborate side rails. The deck is 255 metres long. The bridge was built by the Country Roads Board in two stages between 1931-36, during which its height was raised after the original bridge superstructure

was washed away in record floods of January 1934, prior to its original official opening. In its reconstructed form the original concrete abutments were turned into additional piers and the welded-steel trusses were cantilevered back over them to meet the new higher road approaches. The bridge is approached through some of Victoria's grandest scenery, and spans a broad, deep and spectacular gorge of the upper Snowy near its junction with the Deddick River.

McKillops Bridge is of historical, scientific (technical), and aesthetic significance to Victoria.

It is of historical significance for its particular association with Victoria's long and important pastoral history. It is sited at 'McKillops Crossing', named after pioneer overlanding squatter George McKillop who crossed here in 1835. This was a stock crossing place for almost a century before the bridge was constructed, and many of the livestock that had been used to open up vast tracts of the Port Phillip District for pastoral occupation had come this way from the high Monaro of New South Wales. It had long been the site of the famous 'Turnback' ferry. Built largely to allow the easy passage of livestock across the high country and between NSW and Victoria, it is a rare example of a major livestock bridge, and one of very few surviving timber bridges of this type. It is also significant as part of a Developmental Road scheme, wherein the catchments of the Upper Snowy River were opened up for closer settlement largely through the instrumentality of the CRB. McKillop's Road, built through remote forest lands to encourage rural settlement, and the bridge, represent the very essence of inter-war Developmental Road theory.

It is of scientific (technical) significance:- as an exceptionally long timber or part-timber bridge, and as the longest example of timber deck metal truss bridge in Victoria; as a bridge of exceptional height; for its elaborate timber stockbridge and horse-vehicle superstructure; for its excellent integrity and condition; and as a rare surviving example of a concrete, metal-truss and timber bridge. It combines a colonial era all-timber stockbridge with the (then) latest welded-steel technology. CRB experimentation with electric arc-welding, combined with the necessity for economic innovations during the Great Depression, resulted in the bridge being at the leading edge of world technology. The arc-welding technique was thought to be in advance of British technology at the time, and also created interest in America. It was claimed to be the longest arc-welded steel truss road bridge in the world, and regarded as one of the standing wonders of Australian road-bridge engineering.

The bridge is of aesthetic significance for its impressively long and handsome timber stock-bridge superstructure, combined with modern bridge technology of grand proportions, viewed against a panoramic backdrop of mountain forest and a magnificent Alpine river-gorge. It is also a vantage point from which to appreciate something of the awe felt by pioneer pastoralists picking their way through rugged high-country mountain passes, and the landscape of the Snowy River which is at the core of much of Australia's balladry, folk-legend and mythology.

4 Assessment of Significance

4·1 Historical significance: See section 3.5 above.

4·2 Historic Individuals or Association: None found.

4·3 Creative or Technical Achievement: See section 3.5 above.

4·4 Research Potential: The two references to this document by Rhonda Coates and George Seddon represent a very adequate documentation of McKillops Bridge.

4·5 Social: The local community around the bridge site has always maintained a deep interest in the bridge. There is very much a feeling that it is 'their bridge'.

4·6 Rarity: The combination of a very large structure supporting a very conventional (for its time) timber deck is unusual although the individual elements of the bridge are less unusual.

4·7 Representativeness: The concrete piers/steel trusses and timber upper-works of this bridge together with its length and height over the deep canyon of the wild Snowy River put McKillops Bridge into a class very much of its own.

4·8 Integrity/Intactness: There have been virtually no changes to the bridge since it was built 84 years ago. The bridge has remained in highway service and is therefore adequately maintained by the CRB (originally) and now by VicRoads.

4·9 Statement of Significance: See the Statement of Significance by Heritage Victoria in the Historic Notes section above.

4·10 Area of Significance: The bridge is certainly of State Significance in Victoria and is also of National Significance due to its size and its positioning on an important interstate stock route.

5 Interpretation Plan

5·1 General Approach

It is not yet clear if McKillops Bridge will have a Marking Ceremony or will be marked with Virtual Interpretation. This will depend on the enthusiasm of the local Council, VicRoads and other stakeholders, who have yet to be approached to determine its level of support for the marking.

If there is a ceremony is to be held and interpretation panel to be erected, suitable sites exist on the eastern side of the river, north of the bridge. The site for the panel should be near the bridge in a safe location, with approval from the VicRoads and/or the Council.

A site survey carried out by Owen Peake on 5 April 2019 to determine the possibilities for a ceremony location and to form the basis for a submission to the East Gippsland Shire Council.

5·2 The Interpretation Panel:

If an Interpretation panel is to be constructed it will likely have the following characteristics:

1 A title “McKillops Bridge”.
2 Logos of Engineers Australia, East Gippsland Shire Council and VicRoads to be incorporated.
3 A small scale representation of the EHA marker plate.
4 The date and other details of the marking ceremony.
5 Body text should be 24 point Arial Bold.
6 A map showing the location of the bridge on a map covering the Gippsland plains, Monaro high plains and the intervening Snowy River Valley.
7 At least 4 images with brief captions.
8 Total text should not exceed 500 words excluding headings.
9 Size to be nominally 1200 mm wide by 600 mm high.
10 The panel to be constructed of vitreous enamel-on-steel plate with flanges as per EHA standard drawings.
11 The panel to be mounted on a steel free-standing frame as per EHA standard drawings.
12 The EHA marker to be mounted below the interpretation panel as per EHA standard drawings.

There is an existing very simple interpretation at the parking area on the eastern side of the river. A more comprehensive EHA standard panel would be a useful addition to information for visitors but should not be located too close to the existing panel.

5·3 Possible Interpretation themes for Interpretation Panels

The following subjects have been assessed as possible themes for the interpretation panel:

a) The history of the crossing of the Snowy River at McKellar's Crossing.
b) The story of the construction and reconstruction of McKillops Bridge.
c) Communications on the route today.

6 References:

George Seddon, Searching for the Snowy, published by Allen & Unwin Pty Ltd, 9 Atchison Street, St Leonards, NSW 2015, Australia, 1994.

Rhonda coates, McKillops Bridge – The history of a superstructure over the Snowy River, Tubbut Neighbourhood House, McKillops Road, Tubutt, Victoria 3888, Australia, 2014.

McKillops Bridge. Close up of pier and trusses. The pier is the most easterly pier viewed from the upstream side.

Image: Owen Peake.

7 Acknowledgments, Authorship and General Notes

7·1 Nomination Preparation

This nomination was prepared by:

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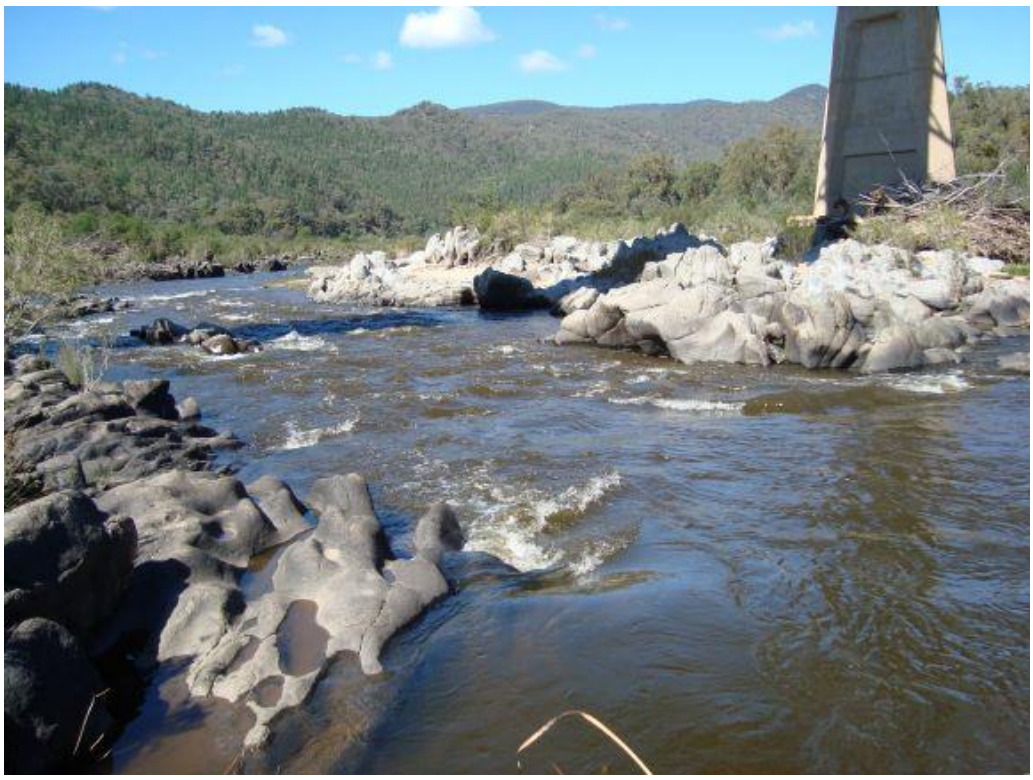
7·2 General Notes

This document has been prepared in accordance with the Commonwealth Government Style Manual for authors, editors and printers, Sixth Edition, revised by Snooks & Co, 2002.

Appendix 1: Images with captions

Air photo of McKillops Bridge. Image: Google Earth.

McKillops Bridge deck in 2010. Note running strips. Image: Owen Peake.



Snowy River below Mc Killops Bridge deck in March 2010. Note that the river is low at the end of summer. Image: Owen Peake.

Country roads Board (CRB) marker on pier at eastern end of bridge. Clearly this marker predates the demise of the first bridge. Image: Owen Peake.

Debris around a pier in the river bed.
This illustrates the danger that destroyed the original bridge.
Image: Owen Peake.

VicRoads bridge number plate on McKillops Bridge. Image: Owen Peake.

Timber decking members (vertical) and running strips on McKillops Bridge. Image: Owen Peake.

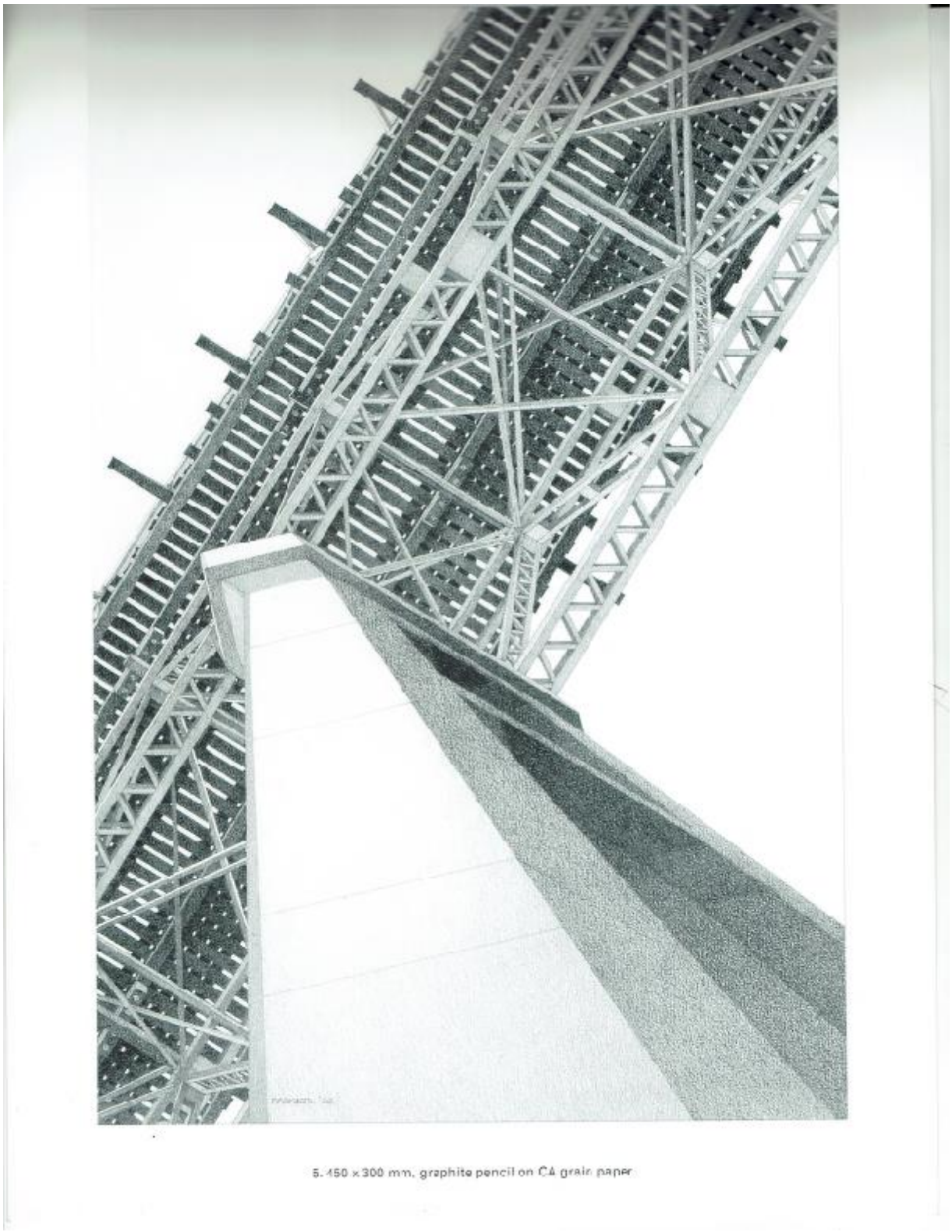
Appendix 2: Construction Details:

2. 570 x 570 mm, graphite percil on vellum

Drawing by Kevin Parker of McKillops Bridge looking along the bridge from the centre line and showing details of the steel trusses. All the members of the main trusses are fabricated by electric welding. Horizontal and vertical diagonal bracing of the trusses is visible.
With permission from artist Kevin Parker.

11. 450 x 515 mm, graphite pencil on CA grain paper

Drawing by Kevin Parker of McKillops Bridge showing details of the trusses and timber upper structure and how they are connected. The lowest member of the timber upper structure can be clearly seen. The transoms are square in section and extend just beyond the outside edges of the trusses. They are grey in colour in this drawing.
With permission from artist Kevin Parker.



Drawing by Kevin Parker of McKillops Bridge looking up as if from the river bed with a pier filling much of the drawing. The trusses and horizontal bracing can be seen from almost directly below. Further detail of the timber upper structure can also be seen including the irregular lengths of the decking planks. The longest planks support the handrail bracing struts.
With permission from artist Kevin Parker.

Steel angle set into the upstream face of a pier to help resist the impact of debris in the river during flood events. Note that the upstream edge of the pier has an included angle of about 90 degrees to assist water flow around it.

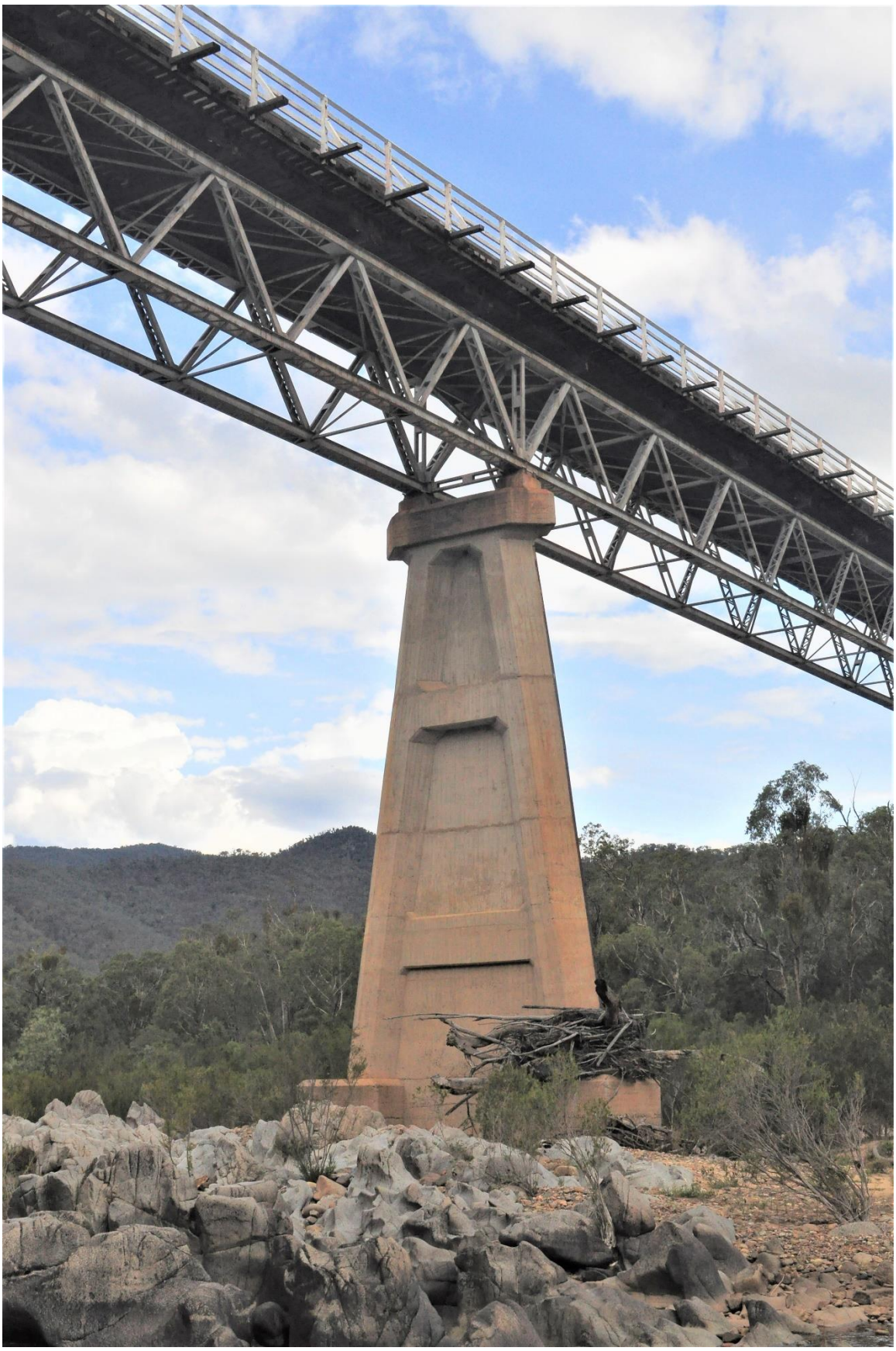
Image: Owen Peake.

The eastern abutment of the bridge. Image: Owen Peake.

Short cantilever section between the eastern abutment and the adjacent road. Image: Owen Peake.

Detail of deck over gap between decking timbers. Handrail is out of frame to the left. Running strip is at the right hand edge of the image. The longitudinal timber girder can be seen through the narrow space running up/down the image to the middle left and the top of the truss can be seen at the middle right inboard of the longitudinal girder timber. Image: Owen Peake.

SPACE FOR DIAGRAM OF UPPER STRUCTURE CROSS SECTION DRAWING



The central pier which was toppled when the first bridge was destroyed and later rebuilt, higher and more resistant to debris damage. Note that there is debris accumulated against the upstream face of the pier. Image: Owen Peake.

Detail of handrail looking from the deck directly at a handrail post. Note that there is a heavy top rail mounted diamond-style and four rectangular rails, closer together near deck level.

Wire netting has been used to further increase the security of the handrail.

Image: Owen Peake.

Looking along the handrail, just outside the roadway. The fixing of the top diamond-style handrail member can be seen using straps over the rail. The wire netting can also be seen.

The diagonal struts to support the handrail can be seen bolted to the handrail posts part way up and fitted into a recess and bolted in the extended decking timbers.

Image: Owen Peake.

Appendix 3: Human Impact

In his book Searching for the Snowy, George Seddon wrote a short section talking about the human impact of the Snowy River. This text comes from page 11 and is reproduced with full thanks to George Seddon:

There is probably no part of Australia in which the landscape has not been affected by human activity, working along with natural forces; even the typical hard-leaved Australian vegetation evolved partly in response to an increasingly drier climate but Aboriginal fire-use may also have played a part. All of the Snowy country is man-modified; feral cats, brumbies, rabbits, soil compaction, erosion, introduced weeds like the blackberry, all have had an impact. Most of the changes are subtle however, and barely apparent to the casual observer, and of course we have no base-line: the historian's wish for a time-machine to take us back two centuries to see what it was really like before the European invasion is never granted.

Nevertheless, most of the country is now uninhabited, and most of it at least looks primeval and unchanged, with only a few major exceptions. The most significant of these is the Snowy River Hydro-Electric Scheme.

This scheme, of which major construction began in 1951, diverts Snowy water to the Murray and Murrumbidgee Rivers. The scheme utilises water from only the uppermost 14 per cent of the Snowy's drainage basin, and has not greatly reduced mean annual flow through the lower reaches, but it has profoundly modified the river characteristics in the montane section, greatly reduced flow in the Monaro section, for example, at Dalgety, and appears to have substantially altered the sediment transport behaviour of the river by reducing periodic flushing. The scheme has not, however, led to a reduction in the flooding of the Orbost flats.

The valley from Kosciusko to Jindabyne is now well-known to walkers and skiers, and it is quite closely settled after the Beloka Gorge from El Paso past Dalgety to Ironmungie. After Ironmungie, settlement reaches only to the lip of the gorge.

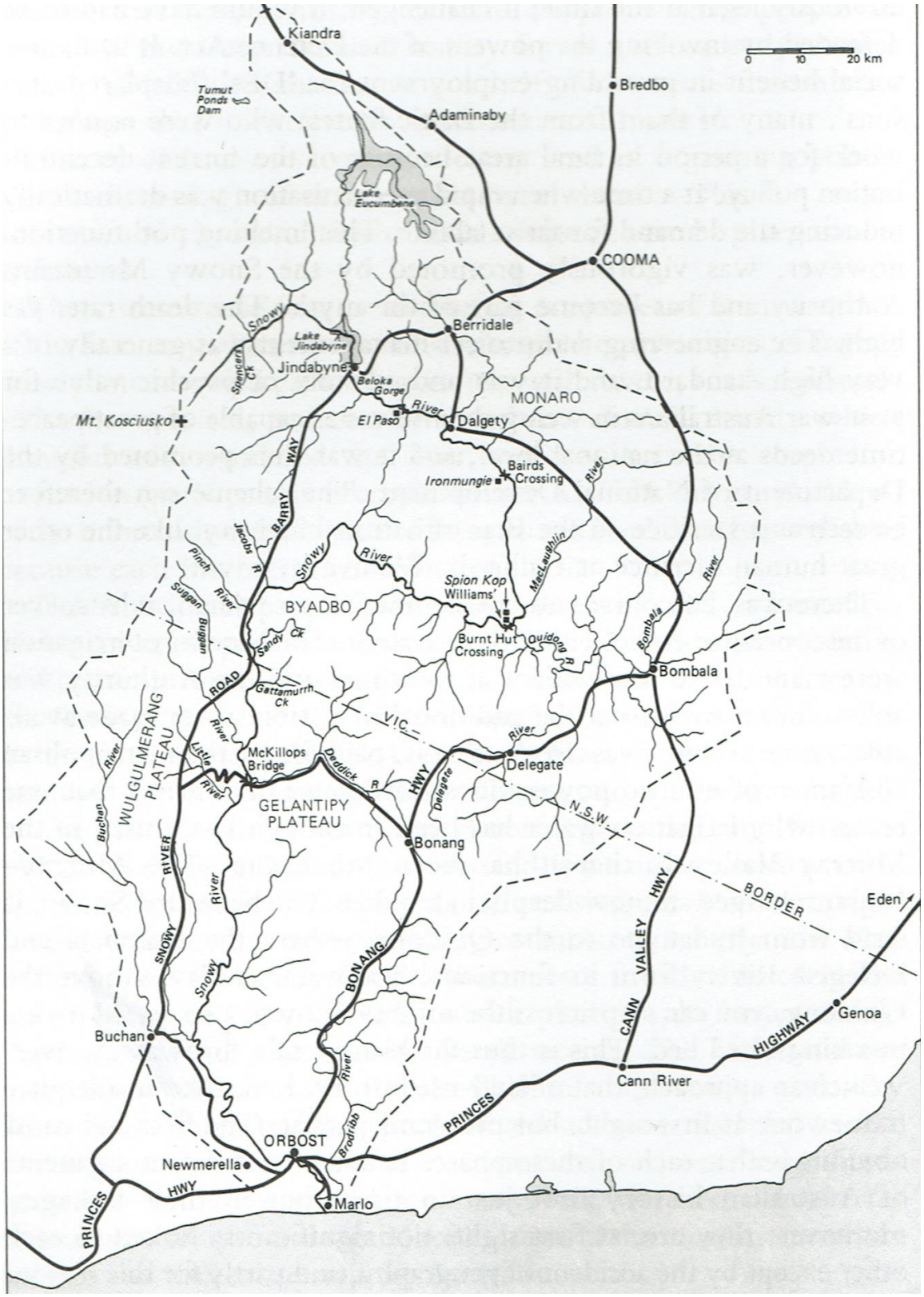
The Orbost flats are extensively settled and cultivated. The Snowy River Improvement Trust has had the responsibility for flood control in this area, and has attempted to achieve this aim by the construction and management of levee banks and gulches. Its efforts have met with limited success, as we shall see later.

Appendix 4: Floods in the Snowy River

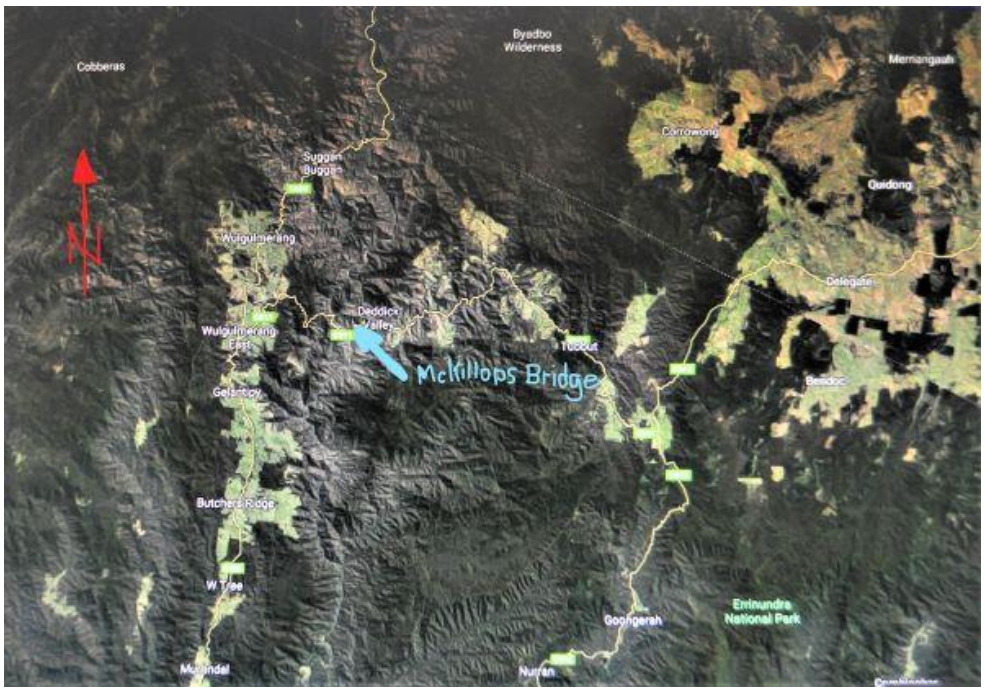
In his book Searching for the Snowy, George Seddon wrote a short section talking about the human impact of the Snowy River. This text comes from page 236/237 and is reproduced with full thanks to George Seddon:

The Snowy can flood at almost any time of the year due to heavy rain in any part of its catchment, but the big floods come most commonly from torrential downpours in summer in the Kybean–Coast Range, carried to the Snowy from its eastern tributaries, the McLaughlin, Bombala and Delegete. It is for this reason that there has been no decrease in the severity of flooding after the construction of the Eucumbene and Jindabyne impoundments, although they have changed the pattern of flooding and therefore of sediment transport. The characteristic flood flow from the High Country before the dams was one of a series of minor floods in late spring and early summer from the rapid snow-melt that flows after a few unusually warm, sunny days. These minor

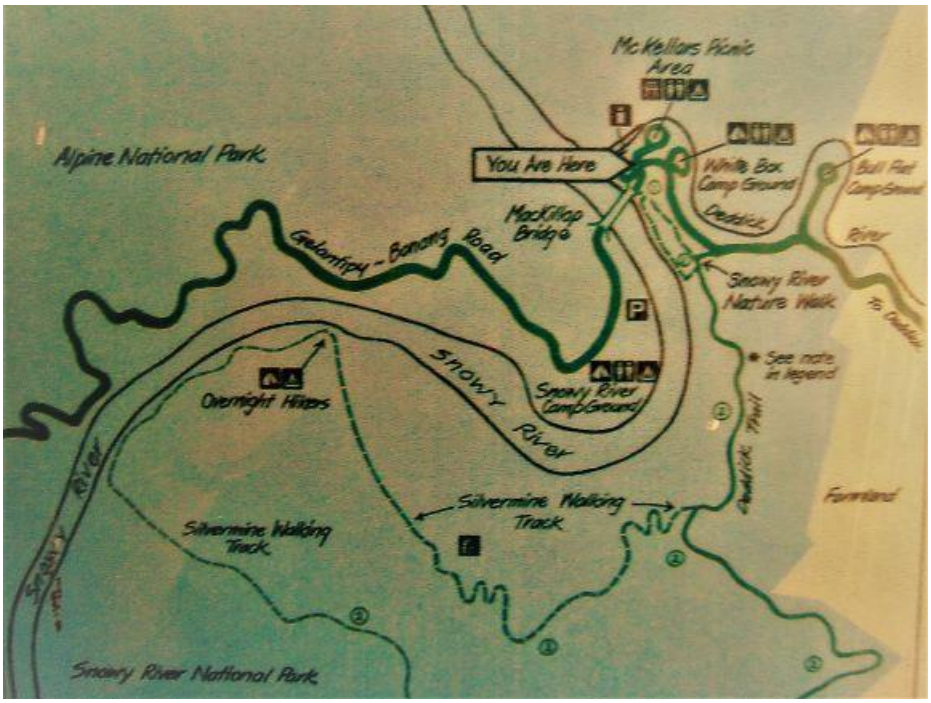
Appendix 5: Maps



The catchment of the Snowy River (dotted line).
Image: Searching for the Snowy, George Seddon, page xxiv



The wider area around McKillops Bridge. Image: Google Earth.



Local area around McKillops Bridge. Image: unknown.

Appendix 6: McKillops Bridge – Searching for the Snowy

In his book Searching for the Snowy, George Seddon wrote a short section talking about the human impact of the Snowy River. This text comes from page 245 and is reproduced with full thanks to George Seddon:

This bridge was begun during the Depression by the Country Roads Board in 1931, designed to have a clearance of three metres above the highest flood in the previous 60 years. The spans were said to have been the second longest welded spans in the world at the time. The bridge was barely completed when the flood, five metres above the previous recorded highest level, dumped masses of debris into the trusses and swept the superstructure 305 metres downstream in a twisted mass. Some of the bridge timber beams were carried as far as Campbells Knob. However, examination of the wreckage showed that the welded joints resisted the forces which twisted the adjacent steel sections, so the engineers actually gained confidence in welding as a result of the disaster. It is hardly surprising that the bridge gave way. Measurement of the flood flow at the McKillops Bridge made by Country Roads Board engineers (Dempster and Ozanne) showed a peak rate of discharge equivalent to 970 000 megalitres per day. Logs built up behind the bridge for half a kilometre before it gave way, and enormous waves estimated as from nine to fifteen metres high, surged across the narrow flats below when the bridge released this load.

Fortunately, a favourable set of circumstances reduced the effects of this great flood on the Snowy flats. The heaviest rainfall had been in the New South Wales catchment, so the local streams in Victoria were not especially high and the flood peak tended to flatten as it passed downstream. The Brodribb did not flood—the lower flats were clear and able to take water from upstream. There was a low tide, an offshore wind, and the river broke through at Marlo, so the main flood was able to make a good getaway. It could have been much worse, given the enormous volume of water, estimated at more than twice the capacity of Eildon Reservoir (McLennan, 1972). McKillops Bridge was redesigned and re-opened in 1937, higher, and with solid concrete pillars.

Appendix 7: Characteristics of the Snowy River

In his book Searching for the Snowy, George Seddon wrote a short section talking about the human impact of the Snowy River. This text comes from page 247 and is reproduced with full thanks to George Seddon:

The management of the river and its environmental history are typical of the history of other Australian rivers, exaggerated by the special characteristics of the Snowy: it is a fast flowing stream by Australian standards, with a fall of 2100 metres from source to mouth, draining an area of 15 500 square kilometres. The Snowy and the Goulburn have the largest average water volume of any of Victoria's rivers. Through much of its course, the Snowy is confined to a deep valley, and the sandbar at its mouth is subject to strong and variable tidal action. It can flood widely only over the last 30 kilometres of its course, and it is hardly surprising that it does so. It must always have flooded, in fact the silt is 80 metres deep at Orbost. As we have seen, however, the floods have increased in severity over the years, and have become far more destructive

Appendix 8: Approaches to the Bridge

8·1 Western end of the bridge·

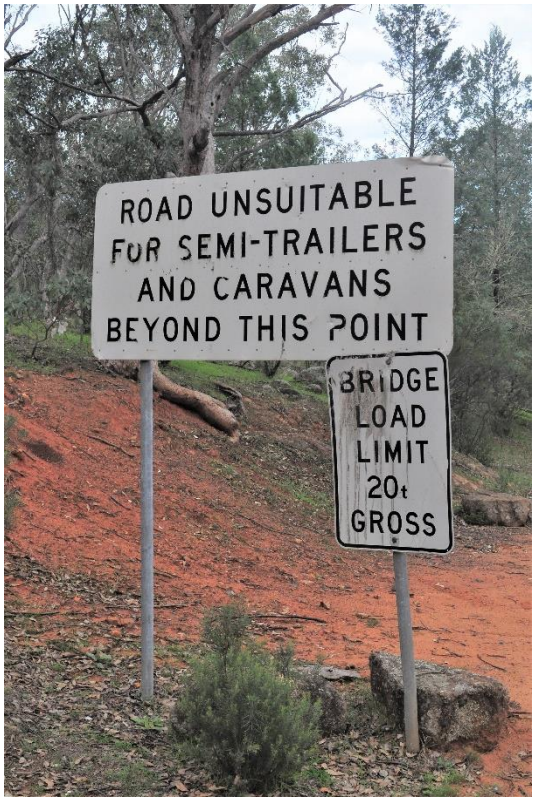
The western approach to the bridge from Buchan and Gelantipy is very steep, winding and narrow as it enters the Snowy River Gorge. Most of the road is gravel and parts are badly corrugated. On my most recent trip on 5 April 2019 this 25 km section took 45 minutes for an average speed of 33 km/h.

The last 10 km or so is particularly dangerous and is regarded by many as the most dangerous section of road in Australia. For all if this section there are no guard rails and there are few opportunities to pass for vehicles coming in opposite directions. The road is restricted from towing caravans and articulated trucks are not allowed. It is often necessary for one vehicle to back to the nearest passing place on a road just wide enough for a single light vehicle. At passing places there is seldom little room for passing of two vehicles. It is customary for the vehicle on the inside to stop as close as it dares to the often very steep table drain with the rock face just mm away from the side of the car. The car on the outside then passes with perhaps 100 mm clearance between the cars and taking great care that the outer edge of the road is strong enough to support its weight.

On my most recent trip I had to pass 4 vehicles going down and 5 coming back up. It is nerve-wracking even for the most experienced drivers. I was thankful that my 100 series Land Cruiser has constant four wheel drive. Low gears were very useful but the road was not so steep as to make use of low ratio on the transfer box necessary.

Approach signs at McKillops Bridge, western side. Image: Owen Peake.

8.2 Eastern end of the bridge.



Approach signs at McKillops Bridge, eastern side. Image: Owen Peake.

Approach to McKillops Bridge from the eastern side from Deddick, Bonang and ultimately Delegate in NSW and Orbost in Victoria is much less difficult than from the western side.

In the immediate vicinity of the bridge there is a camp ground, boat launching facilities and some interpretation. Here there is at least space to park safely off the road and walk back the bridge.

Any interpretation erected by EHA or any ceremony site would need to be in this area.

The C611 climbing away from McKillops Bridge to the east. Distances are Bonang 55 km, Delegate 73 km, Bombala 109 km and Orbost 144 km. The track to the parking area, boat launching area and interpretation is in the foreground. Image: Owen Peake.

Interpretation enclosure and parking area on the eastern side of McKillops Bridge.
Image: Owen Peake.

Change Control

CHANGE CONTROL			
VERSION 1	21 JANUARY 2019	FIRST DRAFTING OP	
VERSION 2	3 FEB 2019	3884 WORDS	
VERSION 3	14 FEB 2019	6158 WORDS	
VERSION 4	6 APRIL 2019	7438 WORDS	INCORPORATED 5 KEVIN PARKER DRAWINGS & OP IMAGES
VERSION 5	22 APRIL 2019	7498 WORDS	REVIEW AND MINOR CORRECTIONS OP